

FINDING NEW

GOLD

IN COPPER

► Extending fiber to every premise may be the endgame for every service provider, but the reality is that many operators with existing copper networks can't financially justify that approach for either businesses or residential customers.

To tackle the disparity, service providers are often doing Fiber to the Home (FTTH)/Fiber to the Building (FTTB) in new neighborhoods, and a hybrid copper/fiber approach via Fiber to the Node (FTTN) or Fiber to the Curb/Cabinet (FTTC) in existing neighborhoods.

On the residential side, FTTN has a number of high profile followers, including U.S.-based carriers such as AT&T, CenturyLink and Cincinnati Bell, and European carriers such as BT and Telekom Austria.

Complementing existing and new DSL flavors, particularly ADSL2+ and VDSL2, are three key techniques that claim to theoretically squeeze more out of existing copper plant:

- **Dynamic Spectrum Management:**

Pioneered for DSL networks by John Cioffi, now the CEO and Chairman of ASSIA, DSM enables service providers to enhance rate and reach by reducing or eliminating crosstalk and interference in a DSL network.

- **Vectoring:** Like DSM, vectoring can also mitigate crosstalk issues that can effect large-scale deployments of DSL lines delivering 15 Mbps speeds and above. With the advent of DSM Level 3, a combination of DSM with vectored DSL, proponents claim the technology can not only help service providers expand their respective DSL speeds, but also provide information on how to isolate faults on the copper plant.

- **Phantom Mode DSL:** DSL Phantom Mode creates what is called a virtual or "phantom" channel that supplements the two-pair wire

configuration for copper transmission lines. Experimental lab tests conducted by both Alcatel-Lucent and Huawei demonstrated downstream transmission speeds of 300 Mbps and 700 Mbps downstream rate, respectively, over 400 meters.

But the utility of copper isn't just a consumer broadband data application. Copper is finding uses in the business services market and even in automobiles.

Incumbent and competitive carriers alike are seeing that the "gold" in copper is its ability to be a sound mechanism to deliver higher speed Ethernet services to businesses that were once out of the reach of their fiber network--via Ethernet over Copper (EoC).

Offering speeds that range from as low as 2 Mbps with the theoretical ability to climb to 50 and even 100 Mbps, EoC is putting higher speed IP-based Ethernet services in the hands of users that may not want or cannot afford the cost of an additional 1.5 Mbps T1 line, but want higher speeds. A growing base of traditional wireline telcos such as CenturyLink, Windstream and Hawaiian Telcom and CLECs such as Integra, MegaPath and XO are offering various flavors of EoC to area businesses.

Finally, the IEEE 802.3 standards group is developing a twisted-pair gigabit Ethernet standard supporting the automotive, industrial controls, avionics, and transportation industries. Similarly, the OPEN Alliance Special Interest Group (SIG) in conjunction with the University of New Hampshire-Interoperability Lab (UNH-IOL) is developing BroadR-Reach, a copper-based 100 Mbps Ethernet connectivity specification for the automotive industry.

In this eBook, *FierceTelecom* will explore the ever-changing dynamics of service providers' copper networks and how they are using these new technologies to deliver a wider set of services to consumers and businesses.

BY SEAN BUCKLEY
EDITOR /// FIERCETELECOM

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New Technology Uncovers Gold in Buried Copper

BY JIM BARTHOLD

► You don't need to be an alchemist to turn buried copper into gold; just a telecom engineer with some neat technology.

Until the economy plunged into the toilet—and stayed there—it was assumed that telecommunications providers devour fiber, pumping out multi-megabits of data over glass networks to residential customers. The economy, and the emergence of a new stream of technologies designed to get more from the copper that's already in the ground, is changing that assumption. Copper advocates now maintain that telcos can compete with cable's high-speed hybrid fiber/coax DOCSIS-based networks without mortgaging the future on fiber.

"The copper pairs in the ground are a wonderful physical medium to deliver IP broadband. Four twisted pairs over 100 meters is gigabit Ethernet. The copper itself is great," said Steve Timmerman, senior vice president of marketing for ASSIA and an avowed copper enthusiast.

Of course if a telco wants to put fiber within 100 meters of a residence, it might as well go all the way to the house which obviates the re-use of any copper. Even Timmerman concedes that point. Right

now, the money-wise move is to continue

an industry progression that began with ADSL and could lead to a fiber-fed DSLAM spitting out a bonded pair of VDSL2-encoded copper wires surrounding a phantom virtual pair on a loop 200-300 meters from the residence. Along the way, those pairs would also have their noise parameters adjusted via Dynamic Spectrum Management (DSM) and then have crosstalk managed or eliminated via vectoring.

Combined and taken to the ultimate end, that process would "break the gigabit barrier" and decimate the need for fiber, said Jerome Joanny, vice president of product management at ASSIA.

That won't happen for a while—if ever—because the industry must first find a way to reliably hit 100 Mbps to meet guidelines being pushed by the FCC's national broadband plan and to effectively compete with cable operators who keep raising the ante.

"Everyone wants to talk about the next greatest thing, but we all know the reality," said Teresea Mastrangelo, founder and principal analyst of BroadbandTrends. "If it ain't broken, don't fix it and if

"Everyone wants to talk about the next greatest thing, but we all know the reality."

**TERESEA MASTRANGELO,
FOUNDER AND PRINCIPAL ANALYST
OF BROADBANDTRENDS**

we can make it a little better we should continue to do that until we determine what we really need."

One could say the telecom network is broken, or at least badly dented. Cable has been eating DSL's lunch for so long that some observers have suggested that the telcos have surrendered. VDSL2 shows promise but it's a short-length solution that only improves if there are long fiber runs to DSLAMs that are then jammed ever closer to end users. That model preserves the neighborhood copper and provides a viable alternative to the ultra-expensive Fiber-to-the-Premises (FTTP) play that just a few years ago was considered the carrier end game; but it's not cheap.

Still, FTTP is now considered a long-term vision for an industry that has to do something competitive now. The best way to do that is to use what's available: copper.

"VDSL2 is a very nice technology on a clean line in the lab with no interference, no crosstalk. You can get 100 megabits per second at 400 meters," said Stefaan Vanhastel, director of fixed access marketing at Alcatel-Lucent.

Of course field conditions and crosstalk and just plain location push that down to 40 Megs at 1200 feet and it's hard to offer that competitively against cable operators who are talking about 300 Mbps. That's where the industry's alchemists rub their hands at the thought of turning copper into gold.

DSM adjusts the configurable parameters on field equipment to accommodate noise not by canceling the noise, but by setting parameters to make the equipment work best in a noisy environment.

Then there is vectoring. Vectoring is the latest, greatest, hottest and

least deployed of all but with the most potential for an infrastructure of millions of twisted pair wires running down every street in the U.S.

"Vectoring is a technology that cancels crosstalk," said Vanhastel. "You measure the noise and generate an anti-phase signal and cancel out the noise for every VDSL line. For customers this results in a very big boost."

It gives VDSL2 the boost it needs to reliably hit 100 Mbps symmetrical under reasonable loop lengths. If carriers want more, they can bond pairs to generate more bandwidth or even add a phantom pair—a combination of the vector-bonded pair that creates a third virtual pair and drive speeds up higher—to perhaps a gigabit.

"If you want to push that further and look at 1 gigabit, you have ITU working on g.fast, which requires that DSLAM to come close enough to the house—200-300 meter loop lengths," said Joanny.

There is, of course, cost involved in all this. As you move deeper into the network with fiber, it costs money and as you transform networks, it takes time. But then, the alternative is fiber and fiber is a long-range project if ever there was one.

"It's the permits, the digging up of the ground, getting all of the new equipment in there to take the fiber all the way to the premises. It's new equipment in the home with a different kind of termination. It's just much more expensive compared to using the wires that are already there," said Jonathan Black, director of CPE marketing for Ikanos.



Black, like most vendors, proposes using a hybrid fiber/copper model.

"Using the existing copper lines becomes a much more attractive thing for the carriers to do; taking advantage of that and getting the most out of the existing copper rather than spending the money to take fiber all the way to the home," he said.

And it doesn't take as long as building out a fiber plant—even if the money is there.

"At the end of the day, it's about return on investment. You want to invest in something that you're going to have a guaranteed return and return quickly. There is a market-driven need," said Abish Ghimire, associate product manager at Sunrise Telecom.

There is the normal downside to any such project with new technology and old infrastructure.

"You can definitely do it, but you have to do a fair amount of planning with your outside plant; there are a lot of caveats about what's running in that copper binder that you have to be aware of before putting

vectoring pairs on there," said Mastrangelo.

Ironically, the same economic doldrums that have pushed operators to look at re-using copper have also produced one of the big reasons why they may forego that model and go directly to fiber.

"A lot of them don't have the engineering expertise that's required and it's easier to just go ahead and start over building the fiber network," Mastrangelo said.

This is fine, if you have the time. With cable operators breathing down their broadband necks, though, most operators don't have time, let alone money, to roll out fiber.

"Many of them must react to competitive pressures and to come up with new ways to launch revenue-generating services," said Kevin Morgan, director of marketing communications at ADTRAN.

To get there, they might also have to overcome a hurdle placed in their way by their own industry.

"There's a lot of fears that if (service providers) continue to invest in copper they're looked at as not being innovative," said Mastrangelo. "There's this misconception that everybody needs fiber and we should be deploying 100 megabit and gigabit services to everybody in the market."

Vectoring provides a stepladder to reach that pinnacle without tearing down the existing infrastructure.

"Everyone in the industry is waiting with bated breath in terms of what it's going to be able to accomplish," said Morgan. "It has yet to be proven what it's going to do (but) the target is 100 Megs for the downstream."

This is, in the end, the target to hit first before aiming at any other speed point. ●

Ethernet-Over-Copper: More Than a Stopgap Measure

BY JIM BARTHOLD

► Ethernet-over-copper (EoC) might be confused with a stopgap technology that spans the commercial services space between reasonably reliable, reasonably high-speed VDSL and totally reliable, incredibly fast fiber. It's not. EoC resides in a place of its own as a viable, reliable way to optimize legacy copper to crank out low-end fiber-like speeds of symmetrical bandwidth that far exceed the more common—and certainly more antiquated—T1s, on which many businesses continue to rely on today.

Importantly, where a 1.544 Mbps T1 is about flexible

as a lead pipe, EoC offers bends like fiber by delivering speeds as low as 3 Mbps symmetrical and, with proper bonding and other considerations, as high 90 Mbps. That top end, it should be noted, isn't really what anyone wants: the EoC sweet spot is 3-10 Mbps.

It all starts with "legacy copper facilities that Ma Bell has had in the ground in some cases for 100 years," said Mark Stokes, director of business development for Spirit Communications, a South Carolina-based business-oriented communications service provider.

"We're using Ethernet-over-Copper as a way to get higher speed broadband connections to smaller customers," said Stokes,

calling EoC "a lower cost method of delivery" and a "more reliable connection to customers rather than traditional T1s."

Those two characteristics—lower cost and reliability—form the foundation of the technology and are why EoC is a commercial, not residential service. EoC burst onto the scene at the right time for small-medium businesses that cannot afford to purchase budget-busting fiber connections but need something more than a T1—or even a VDSL line—to feed their increasing data appetite.

"As small and medium businesses are finding the cloud and putting more data outside their office and people are working remotely with more interoffice communications, DSL just isn't cutting it anymore," said A.J. Byers, executive vice president of Primus Business Services for Primus Telecommunications Group Inc. (PTGi).

DSL might be in the right price range—\$50 to \$125 a month in Canada where PTGi operates—but that's about it. The reliability is just not there for a commercial customer. On the other hand, until EoC came along in the last decade or so, there wasn't much choice. Fiber service in Canada can run in the \$850-plus

range per month.

"We're fitting Ethernet-over-copper in the \$400 to \$600 price range and giving those small- and mid-market businesses the speeds other businesses are buying fiber for and really enabling them to leverage remote workers and multiple office locations and the cloud," Byers said.

EoC was almost thrust upon PTGi. Until recently, when the foreign ownership rules changed in Canada, the company couldn't build out fiber so it had to buy copper from the ILECs. Now, with the rule changes, it can build fiber—as it is doing in Ottawa—giving it an evolutionary product offering, Byers said.

"If you're a small business you could start with DSL, migrate to Ethernet-over-copper and then migrate to fiber as required," he said. "We're finding that most small-medium businesses now are entering at the Ethernet-over-Copper level."

This is especially true for "customers that are looking for less than 10 Meg," said Stokes. "If you're going to put fiber in and give that customer a true Ethernet fiber connection there's going to be a minimum level of cost that makes it almost cost-prohibitive for a customer that's only looking for 3, 5, 8 Meg. The cost for copper is much lower."

A 3-8 Mbps EoC feed costs a Spirit customer about \$70 a month versus a \$400-\$500 fiber feed.

"We do have some customers that would rather have fiber ... but we're telling the customer it depends on the needs of their business, how much bandwidth they need to accomplish their goals," he said.

Of course, Ethernet technology is Ethernet technology, so there's



"A lot of people are under the impression that copper is actually dying. To the contrary, local exchange carriers are still really supporting voice service customers on POTS so there is copper that needs to be maintained, kept up to date."

PASHA MOHAMMED, DIRECTOR OF PRODUCT MANAGEMENT FOR ACCESS SERVICES AT MEGAPATH.

always the migration path.

"The transmission technology that's being utilized over that transport facility is the same; it's just a matter of the amount of bandwidth," he said. "Any customer could look at a higher speed bandwidth connection such as fiber, but in a lot of cases, Ethernet-over-Copper would provide the businesses all they need for the foreseeable future."

Perhaps the only perceived problem with building a business on copper is the copper itself: how much there is and what condition it's in.

"A lot of people are under the impression that copper is actually dying. To the contrary, local exchange carriers are still really supporting voice service customers on POTS so there is copper that needs to be maintained, kept up to date," said Pasha Mohammed, director of product management for Access Services at MegaPath. "Secondly, the pace at which cable services are taking over broadband is freeing up a lot of copper in the neighborhood which means more of those strands are available for businesses."

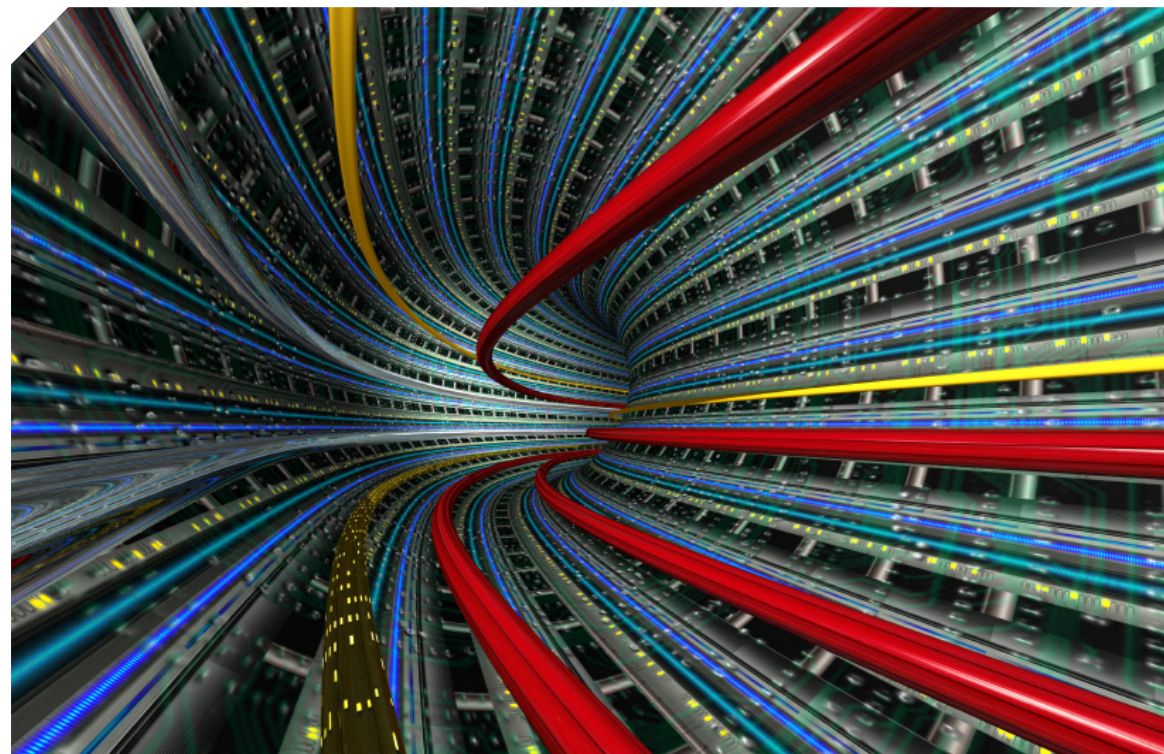
Of course, this broadband competition is also leading some telcos to remove copper and install fiber.

"When that happens, what happens for us is we lose the ability to buy or lease copper from the central office to the user location," said Mohammed. "When we get into this fiber-to-the-curb scenario we won't be able to have access to the copper anymore."

Another problem is the condition of the copper.

"(Some) telcos don't want to manage the copper plant anymore," said Byers. "I don't think they're ripping any out but there's not an over-abundance of copper. I wouldn't say there's a ton of extra copper sitting around."

Which is a shame, in a way, because in this economy where businesses are looking to expand without paying the price to do so, it seems that Ethernet-over-copper is, as Stokes put it, "a capability that's out there to continue to provide quality services at a lower cost for businesses, allowing them to reduce their telecom expense and hopefully grow their businesses accordingly." ●



MegaPath, EoC Fit the Bill for L.A.-Based Telecom Consultant

BY JIM BARTHOLD

► For the last 25 years John Kippen has made his living advocating the best telecommunications services for a client list dominated by Los Angeles and New York-based commercial production companies. These are people in the television business that have to shuttle huge swaths of content from one site to the other quickly, reliably and, if at all possible, inexpensively, which means the president-CEO of JDK Consulting must come up with the cheapest, most reliable, way to do it.

He generally advocates Ethernet-over-copper (EoC) as the network technology and MegaPath as the service provider. For a new technology, he said, EoC delivers a bang for his clients'

bucks.

"EoC is better than bonding T1s because when you bond T1s together, not only is it much more costly but if you have one T1 that's failing or having problems, it affects the performance of the entire circuit and brings the circuit down," he said. "If one of the pairs in the EoC circuit fail, all they lose is a percentage of the bandwidth."

Kippen's clients—who also include doctors and attorneys and other small businesses—want reliability and speed but not necessarily fiber. Many just want something better than a cable modems.

"The problem is that if you max out the upload speed on a cable modem it makes the entire modem unstable," Kippen said. "With EoC that doesn't happen."

Besides its reliability, EoC

is cheaper and increasingly competitive with fiber so he can broker better deals for his customers.

"EoC product is forcing the cost of fiber connections to come down," he said. "I get a quote for fiber in a building and when EoC becomes available I go back and get a new quote letting them know EoC is available. I can get a fiber quote to drop in half. EoC is really causing fiber providers to provide competitive prices."

Not that he would readily suggest fiber to clients looking for the most bang for their bucks.

"While I wouldn't recommend EoC for every one of my customers, for the guys who are really looking for 10 to 20 megs I would much rather spend the money on an EoC circuit and have a cable modem as a failover instead of the big money they would spend with a single fiber," he said. "Clients don't know; they just rely on my advice and I'm sensitive to the amount of money

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Ethernet over Copper: Five Benefits for Business Services

BY D. MARK DURRETT, DIRECTOR OF MARKETING, OVERTURE

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and multiple service classes. The leading EoC solutions include identical management, resiliency and QoS features as their fiber counterparts, allowing providers to deliver a customer experience equal to fiber-based Ethernet services.

4. TECHNOLOGY INNOVATIONS DRAMATICALLY ADVANCE EOC CAPABILITIES

From just 2.3 Mbps per pair in 2003 to over 15 Mbps symmetric per copper pair today, service providers deploy 200+ Mbps Ethernet over a new generation of EoC edge and aggregation equipment by bonding multiple copper pairs at a fraction of the cost of fiber-based Ethernet services.

5. ADVANCED SERVICE MANAGEMENT MAKES IT EASY

EoC solutions with zero touch provisioning, built-in diagnostics and intelligent demarcation features ensure dramatically simplified service delivery. Quickly turning up services and assuring service performance meets SLAs, while troubleshooting network problems on the fly, gives service providers control over the entire service path between network hand-off points at the UNI and ENNI.

SIMPLY GOOD FOR BUSINESS

The immense popularity of Carrier Ethernet for business WAN service creates demand that cannot be met with fiber alone, however, advances in EoC give service providers and network operators plenty of good reasons to make it a strategic part of their technology mix. ●

► Today's business applications depend on IP and Ethernet protocols, and Carrier Ethernet has emerged as the wide area network (WAN) technology of choice for enterprise access. Whether used for dedicated Internet access, connections to private cloud applications or virtual private networks, Carrier Ethernet promises an efficient, simple, scalable and cost-effective solution. Vertical Systems Group projects Ethernet for business applications will grow at a compound annual growth rate of over 18% through 2015.

Among technologies that deliver Ethernet-based business service, fiber optic connectivity is preferred for its near limitless capacity and reliability. But Ethernet over Copper (EoC) has become a strategic choice for delivering competitive Ethernet services. Here's why:

1. IT'S ETHERNET

Many technologies promising broadband to consumers and businesses are typically used only for Internet access or basic voice services. Ethernet, as defined by the Metro Ethernet Forum (MEF), meets

business-class symmetric service requirements, providing scalable, reliable, manageable features with quality of service options. Contrasting other broadband technologies, EoC delivers the MEF-compliant, business-class Ethernet enterprises expect.

2. FIBER OPTIONS CAN BE LIMITED

Nearly 70% of business locations in the US can't access fiber. These locations may not warrant the cost of fiber and those that do may not be able to wait 6-18 months to "light" their building. Yet, all business facilities are connected to the legacy copper voice network where EoC can be turned up in a matter of weeks. Many providers have found they can increase their addressable market for high-speed Ethernet services by ten-fold with EoC compared to a fiber-only strategy - an attractive proposition.

3. EOC DELIVERS ON PAR WITH FIBER

Today, nearly all service providers have Ethernet service offerings, including many premium products backed by service level agreements (SLAs) supporting multiple services

OVERTURE 

New Technologies From the World's Ubiquitous Wired Connectivity Standard, Ethernet—a.k.a. IEEE 802.3

BY WAEL WILLIAM DIAB, VICE-CHAIR IEEE 802.3

► It is an exciting time to be a part of the IEEE 802.3 Working Group. Known simply as "Ethernet" IEEE 802.3 technologies have become the ubiquitous wired connectivity of choice. Today, as much as ever, 802.3 is taking on new challenges and further expanding its application horizon.

Known simply as "Ethernet" IEEE 802.3 technologies have become the ubiquitous wired connectivity of choice.

From an industry perspective Ethernet is serving new markets, including:

- In September 2010, IEEE Std 802.3az-2010, more commonly known as Energy Efficient Ethernet, took a revolutionary approach to the communication between link partners, increasing the ability to save power when there was no information to be exchanged and the ability to let a partner know nothing is coming in real time so it can save power up the OSI stack. The result? Ethernet-based systems that can deliver dynamic



power proportionate to load. It is estimated that energy savings resulting from the adoption of IEEE Standard 802.3az-2010 may exceed \$400 million per year in the U.S. alone (and over \$1 billion worldwide).

- In March 2012, IEEE 802.3 authorized the formation of a study group to consider a reduced twisted pair gigabit Ethernet solution. This study group is looking at running the popular gigabit Ethernet over twisted pair but using less wire. The applications span automotive to industrial, avionics, and more, further opening up the use of Ethernet. The automotive industry is moving toward Ethernet-based

in-car networking, and reducing the number of wire pairs would significantly lower the size and weight of Ethernet wiring in a vehicle.

- Last year, IEEE published two standards enabling two more application spaces: IEEE Standards 802.3bd-2011 and 802.3bf-2011. The first is targeted at Data Center Bridging, which allows Ethernet to manage congestion and data flow in data center environments. The second was aimed to support the ever-popular Audio Video Bridging standard suite that allows seamless delivery of content over a multi-hop network.

From an adoption perspective

Ethernet is taking on new challenges as well. Let's look at some examples:

- Ethernet has consistently and reliably addressed the need for speed over its lifetime. IEEE Standard 802.3ba-2010 did that by specifying the future rate of Ethernet. Key in the development of the project was the recognition of an emerging set of requirements in the light of 10x speed for 3x the cost. Specifically, with the solidification of the datacenter business as its own space, input/output bandwidth requirements are distinct, doubling every 24 months rather than every 18 for core. This creates a bifurcated trajectory for speed that the project captured by specifying both 40G and 100G solutions.

- The need for speed continued in Ethernet with a Bandwidth Assessment Ad hoc created under the Industry Connections program in the IEEE-Standards Association. The 802.3 Ethernet Bandwidth Assessment ad-hoc concluded its work and its report can be found at http://www.ieee802.org/3/ad_hoc/bwa/BWA_Report.pdf. A new Ethernet ad-hoc group called the IEEE 802.3 Industry Connections Higher Speed Ethernet Ad Hoc has been formed and will look at building consensus towards a higher speed Ethernet

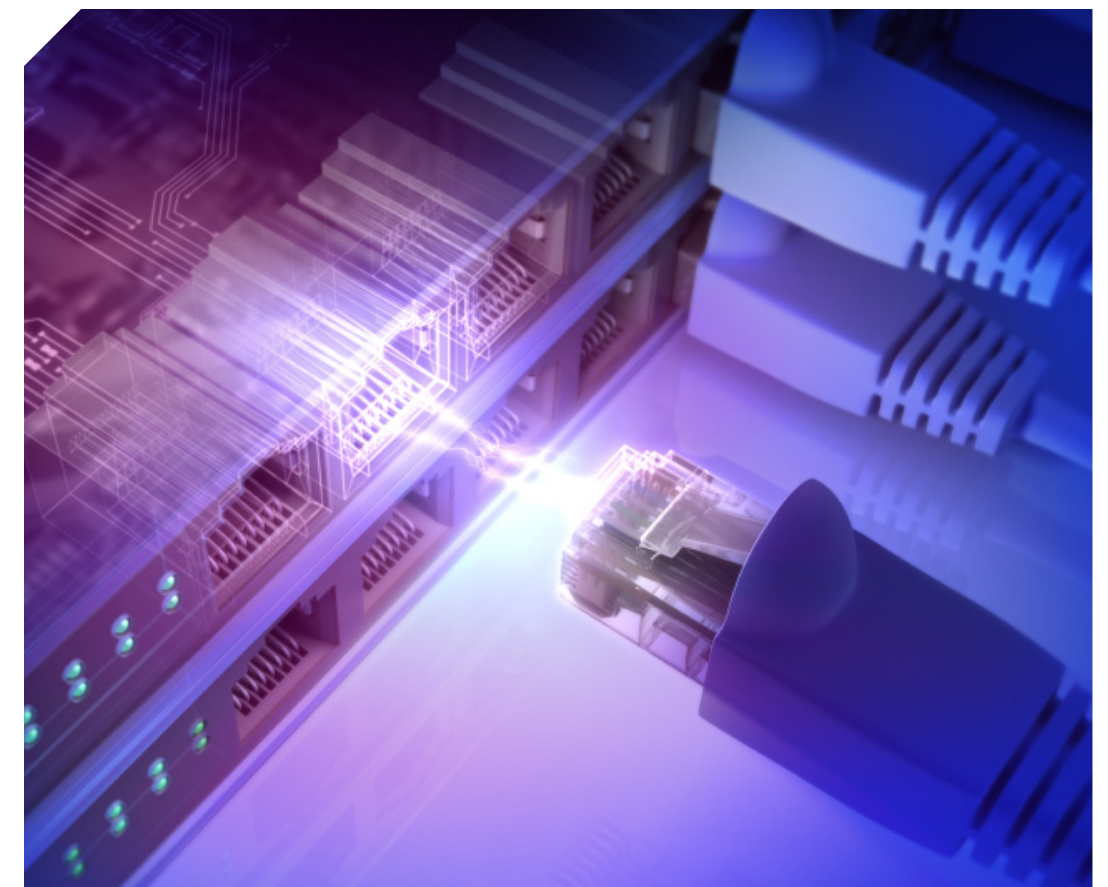
call for interest.

- Finally, Ethernet has taken on new media in its quest to expand vertically. The standards on twin-axial and backplanes specify interfaces on speeds of 10G and above, which have now become part of the solution set. More recently, IEEE 802.3 will entertain a call for interest to consider the next generation BASE-T with an eye on server-to-switch connections in data centers. IEEE and its Standards Association provide a unique framework and environment to create standards. While there is "no one size fits all" wired networking technology, the constant evolution of IEEE 802 and IEEE 802.3 Ethernet and its slew of new interfaces show there are still

Ethernet has consistently and reliably addressed the need for speed over its lifetime.

many new spaces and applications to conquer.

Wael Diab is a Senior Member of the IEEE, serving as Vice-Chair of the IEEE 802.3 Ethernet Working Group. Diab is also a member of the IEEE-SA Standards Board and IEEE Standards Education Committee, Vice Chair of the IEEE-SA Corporate Advisory Group, and serves as the IEEE-MGA liaison to the IEEE-SA. Diab also serves as Senior Technical Director in the Office of the CTO at Broadcom Corporation. ●



Q&A: XO Navigates New Waters to Get More Out of Existing Copper

► XO, along with the former Qwest Communications (now CenturyLink) and Bell South (now AT&T), were one of the early pioneers in delivering Ethernet over Copper (EoC) services to business customers. Sam Koetter, senior product manager, Ethernet services for XO, believes that because XO was an early mover it has learned to not only be flexible but be realistic about what you can actually deliver. Given the variations of the traditional ILEC's copper pairs, Koetter said that any operator delivering EoC has to account for a number of variables, including copper quality, loop lengths and other operational tweaks that are discovered through years of delivering the service. Sean Buckley, Senior Editor of *FierceTelecom*, caught up with Koetter recently to talk about the EoC market and how it has become a sound complement in areas where it has not built out its fiber network yet.



FierceTelecom: Update us on XO's Ethernet over Copper offering. What progress have you made over the past year?

Sam Koetter: We launched Ethernet over Copper (EoC) a few years ago and have focused mostly on expansion into more Local Serving Offices (LSOs) over time. Today, we're up to 447 LSOs where we offer our own EoC service. What we noted a few years ago that the first generation equipment was not going to work for us long-term.

FT: You mentioned there has been a rise in EoC players in recent years. What do you feel is your differentiator over these other players?

SK: A couple of things. One we have been in the game

longer. We knew that when those players came into the market they would steal some of our business. We had some of our customers said 'we're going to start buying from this other provider, which was to add more vendors and not a price issue.' The good thing about XO and others like Windstream is we have our own network so we have 'owner economics' whereas a lot of other competitors don't. They have to lease backhaul and buy extra colo space in those LSOs. XO enjoys owner economics on the services. If it comes down to a price discussion,

We're absolutely seeing strong demand in the data center industry for that range of what I like to call converged cloud offerings.

we can normally win in that discussion. Because we have been in the game longer, we have found that Ethernet over Copper is a bit fickle in terms of rate and reach and tweaking the copper pairs to get them to work right so we learned from that. What some of those mostly other carrier customers that have tried out some of those competitive providers, they have realized that they are not as good at understanding how to make it work because it's a little more art than science sometimes. We have found that our service delivery is better than a lot of those newer folks that have entered the market. Being one of the first markets has helped us.

FT: Being one of the early adopters of EoC, what are some of the real-world lessons learned you can share about delivering EoC service?

SK: Lessons learned is a good way

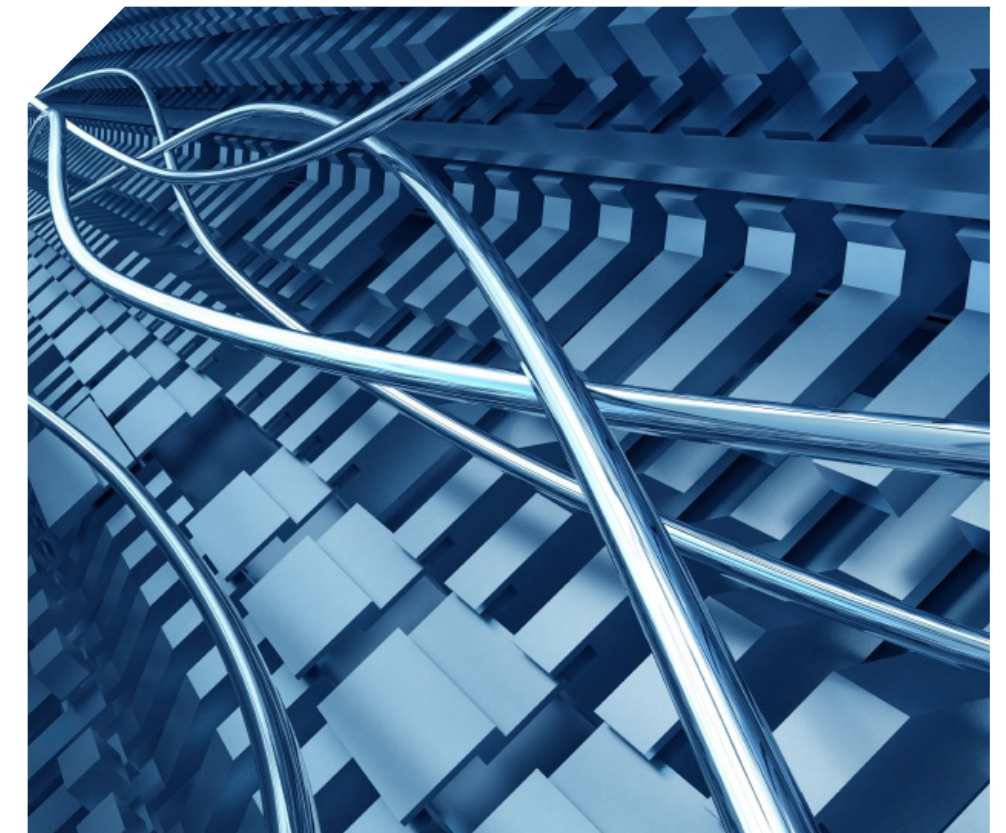
to put it. I think the biggest lesson is don't overpromise and be flexible. We are a little bit flexible. Things like wire distances aren't known until you go out there, test the circuit, and fire a signal over it. Only until then will you know the exact wired distance. Your estimate on whether you pre-qualified that circuit through a LEC tool or some homegrown pre-qualification tool neither one will be 100 percent accurate. We've always been flexible so if we pre-qualified it at 6,000 feet but it turns out it is 9,500 feet we'll add a couple of extra copper pairs to try to deliver what was requested. What we have discovered with working with customers and buying from other providers is that some other providers are not flexible. They will say if it exceeds our policy we'll cancel your order, which is a difficult stance to take when you're dealing with something that's not an exact science. Be flexible is number one. I think learning--and this is more of your operation teams knowing what's going on--because a lot of times make adjustments to those copper pairs to get the bandwidth you desire without having to order more facilities. There are tweaks that can be made to get more out of the copper and it takes time to learn those tricks. If you work with the vendors and ask questions, they'll show you how to get more out of what is already there.

FT: Okay, you mentioned tweaks to deliver EoC more effectively. Would those consist of technologies and techniques or something else?

SK: No, it's just different settings and combination of settings on the copper loops. These would be things like auto negotiate versus manual negotiate and training up

the copper pairs. It's a lot more technical things. If you get some seasoned guys in the activations group and they tell you about things that you can do to help make it work better.

service because of the unknowns in loop lengths and the unknowns as to whether the LEC has the copper. The higher you go in terms of bandwidth, the more those instances are going to come up



FT: The reality with copper is that there's only so much you can realistically deliver to every end user. What speeds is XO delivering today and are there new ones in the works?

SK: To date, we have offered 3, 5, 10, 15 and 20 Mbps. About two weeks ago we launched internally to our sales folks was 30, 40, and 50 Mbps. We have been a little bit intentionally slower in rolling out those higher bandwidths because it gets back to setting expectations. With EoC it's not a 100 percent guaranteed I can deliver that

more frequently. We rolled out 30, 40 and 50 and we do have plans to roll out 60, 70 and 100 Mbps after that which might be some time around Comptel. We want to make sure we're able to deliver what we say we're going to be able to deliver before we swing the gate wide open.

FT: Obviously, XO has a strong fiber-based Ethernet service reach, but are you seeing ongoing demand for higher EoC speeds in areas where

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your fiber is not built out yet?

SK: We see lots of interest. Remember, we're only going to deliver Ethernet over Copper where we don't have fiber. There's a huge interest for it especially as a migration path. I see this as an easier sell to our embedded customer base. We have several thousand EoC customers today. In those customers, we've done the test and turn up and we know the wire distances so that takes the guessing game out of it. If you had a customer that bought 20 Mbps two years ago, and they now are ready for 30 Mbps or 40 Mbps, we can look at their known wire distance and say: 'you're at 5,000 feet and if I add two more copper pairs we can deliver that service to you at a pretty high level of confidence versus the customer you have never done business with and you know you need 12 copper pairs to deliver their service at that higher requested rate.' As you move up in bandwidth for the Ethernet over Copper access, you tend to take on a little more risk.

FT: So what are the risks? Is it the ability of the equipment to perform or something else?

SK: The ADTRAN equipment is not really a limitation. What the risk is not really knowing the actual wire distance and knowing whether or not if you can get the quantity of copper pairs from the LEC. The quality of copper is also always there too. A LEC can have plenty of copper, but it's all in bad shape and does not deliver that optimal performance—that's certainly another factor.



FT: Looking beyond pre-qualification, do you apply the same quality levels to EoC as you would with any other product?

SK: We will specifically test that heavily up front. We know the second that technician attaches the test equipment what the quality of the copper is and what the distance is and know really quick how easy the installation is going to go. These are all concerns associated with all EoC no matter who the vendor is. But to be fair, whenever EoC comes up we talk about customers want to know about performance issues that come up and what's the risk, but the reality is about 95 percent of our installations go through without a hitch. The things we talk the most about happen about five

percent of the time.

FT: Outside of your coverage territory, how do you handle QoS with your External-Network to Network-Interconnection (E-NNI) partners?

SK: We probably a couple hundred interconnects. These are 1 Gbps NNIs with other vendors we use for off-net access to fill in where we can't provide our own access. It's probably spread across 20 different vendors. With some vendors we probably have 10 1 G NNIs in one market because we have utilized them so much. It's basically a paper evaluation. We'll look at your installation times; what does your architecture look like; what technology are you using; what

is your performance SLAs; and what can I expect in terms of jitter, latency and throughput. It's a paper evaluation. We don't always turn up circuits and test them because a lot of times what they tell us it's going to do it will do and two we don't have a lab everywhere. At the end of the day we know not all Ethernet services aren't created equal because how you oversubscribe your network or run your network varies significantly by vendor. Where I am going is just because a vendor has poor SLAs does not mean we won't use them. If they're the only provider that can serve an end-user, we'll let the user know who it is and this is what they can expect in terms of performance and let them decide. ●

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it costs. EoC being a fairly new product really is a good alternative for them."

It helps when using EoC to know the supplier. Kippen likes MegaPath because he can hammer out a good price with the service provider and because of MegaPath's after-the-sale \$10-a-month active monitoring package.

"I make all my clients buy (the service plan)," Kippen said. "I do like MegaPath's service."

Service, while not an after-thought, is more of an after-activity for MegaPath, said Pasha Mohammed, director of product management for access services. First comes the connection.

"We have a history of obtaining copper from the local exchange carriers and using it very efficiently. Throughout our history (including the times before Covad and SpeakEasy merged with MegaPath to create the current company) that's been one of our significant strengths," he said. "We identify what scenarios actually improve the quality of copper. We dig deeper into our history, pull information out of that and do process



"From our point of view, if copper is there take advantage of it."

PASHA MOHAMMED, DIRECTOR OF PRODUCT MANAGEMENT FOR ACCESS SERVICES AT MEGAPATH.

improvements which constantly improve the way we work with the local exchange carriers."

This, in turn, leads to the service that Kippen admires and urges his customer to buy.

For MegaPath, the road to a successful business runs through copper but it isn't a one way street.

"From our point of view, if copper is there take advantage of it," Mohammed said. "Whenever possible we would like to take advantage of copper but we are totally in line with the technological advancements and the limitations of copper so we are embarking on a fiber strategy as well."

In a way Kippen and his customers are on the same course.

"There are certainly benefits of fiber," the consultant said. "You can upscale the bandwidth with a

phone call and it takes three or four days of processing paperwork and they can upgrade the speed. With EoC they would typically have to bring in more pairs."

Cost, though, counts for a lot.

"The cost of EoC nowadays is under \$100 a meg," Kippen said, noting that he recently cut a \$799 deal for a 10 megabit

connection. "The same thing with a 10 meg fiber is going to be \$120 a meg and a lead time for a fiber install in Los Angeles is 60 to 90 days; an EoC installation can be done usually in 20 days."

While Kippen's customers aren't generally looking for very high-speed broadband, MegaPath is always looking at more ways to wring higher speeds from copper.

"We can take up to eight loops and bond them together and we can deliver speeds up to 45 megabits symmetrical," said Mohammed.

"Using the same copper plant, we can do some innovative stuff using an asymmetrical solution we'll be launching but I'm not at freedom to talk about that will be 100 meg at low end of the speed on eight to 12 pairs of customer. When a customer comes to me, depending on the distance, depending on the kind of quality of copper he has access to and how much copper he has, I will suggest one of these solutions."

And Kippen will listen and broker the best deal for his customers who have their own priorities.

"If their business is dependent upon reliable delivery of video to their customers then they put the telecom cost high on the priority list," he said.

When he knows what they want, he said, he takes their needs to MegaPath and "I beat them up a little bit" to get the best deal with the best speed for the best price. And MegaPath digs into its bag of products and comes up with the best solution for all involved—almost always involving copper.

"When it comes to copper and the ability to take advantage of it we leave no opportunity uncovered," said Mohammed. "We practically look into every possible angle of how to take advantage of copper." ●